but these lines, which are reversed, are of such great width that it is at present impossible to say whether they are coincident with lines in the solar spectrum.

April 4, 1878.

Sir JOSEPH HOOKER, K.C.S.I., President, in the Chair.

The Presents received were laid on the table, and thanks ordered for them.

Notice was given that, with a view to facilitate observation of the Solar Eclipse of July 29, the Pennsylvania Railroad Company will convey observers, being private persons, from Philadelphia or New York to Denver and back at reduced fares.

The following Papers were read:—

I. "On the Development of the Parasitic Isopoda." By J. F. Bullar, B.A., Trinity College, Cambridge. Communicated by Dr. Michael Foster, F.R.S., Prelector of Physiology in Trinity College, Cambridge. Received March 14, 1878.

(Abstract.)

The paper contains an account of some points in the development of the *Cymothoa œstroides* and *C. parallela* of Milne-Edwards.

The work was mainly carried on in the Zoological Station at Naples, and the author takes this opportunity of returning his best thanks to Dr. Dohrn and Dr. Eisig for the kind way in which they forwarded his researches.

The eggs were prepared in the way described by Bobretzky in his paper on the development of *Oniscus murarius* ("Zeit. für Wiss. Zool." Bd. xxiv), namely, by heating them in water, and then hardening them, first in bichromate of potash, and then in alcohol, beginning with 70 cent. and gradually increasing the strength to absolute. The sections were stained with Kleinenberg's hæmatoxylin and mounted in Canada balsam.

The eggs when first laid are surrounded by a single membrane.

The earliest stages of segmentation were not observed; the first described is that in which a circular patch of cells has appeared at one pole of the egg. The cells are of considerable size and contain very large granular nuclei; in the centre of the patch they are polygonal, and more than one layer deep, but at the edges they are flattened and form a single layer.

The blastoderm gradually spreads over the yolk, the cells on the

dorsal surface being very thin and difficult to recognise, while on the opposite side they form a thickened patch (the future ventral wall of the embryo), which elongates, and soon shows traces of segmentation.

The procephalic lobes appear first, the other segments are formed in order from before backwards.

A second membrane is now formed round the egg.

The epiblast of the procephalic lobes soon becomes thickened, to form the cerebral ganglion. At the most anterior end there is a separate mass on each side, but in front of the mouth the thickening is continuous right across; it extends backwards, along the median line, to form the ventral nerve-cords and ganglia.

The mouth and, rather later, the anus appear as involutions of the epiblast.

Beneath the epiblast a second layer of scattered cells appears.

The limbs arise as hollow protuberances of the epiblast, filled with cells from the lower layer.

On the dorsal surface a peculiar organ, homologous with the "micropyle apparatus" of the Amphipods, is developed. At a later stage it is situated in the first thoracic segment. It disappears before the adult form is reached.

Just behind the mouth involution a solid mass of cells appears, from which the liver will be developed.

The nervous system, which at first consisted of a continuous mass of epiblast cells, becomes differentiated into a cellular and a fibrous portion. The external layer of cells or epidermis is separated from it, and it becomes segmented so as to form a chain of separate ganglia.

The epiblast covering the head is thickened at a certain point on each side, and from these thickenings the eyes are developed.

The solid masses of cells representing the liver become converted into three cæcal tubes, on each side of the body, opening to the yolk, and quite distinct from both the fore and hind guts.

The heart appears above the hind gut in the abdomen.

The hind gut grows forwards very rapidly, and comes nearly into contact with the fore gut. The liver cæca increase in size and become filled with oil-drops derived from the yolk.

It is now possible to demonstrate, by dissection, that the yolk is surrounded by an exceedingly thin membrane, continuous with the walls of the liver cæca, and opening into the point of junction of the fore and hind guts. This membrane appears to contain nuclei.

As development proceeds the yolk gradually disappears, and the membrane surrounding it disappears also.

The whole of the alimentary canal of the adult is formed from the fore and hind guts.

In the paper an attempt is made to prove the truth of the suggestion, originally put forward by Dr. Dohrn, that the yolk membrane is

the morphological representative of the mid gut, and that the liver really arises as a diverticulum from it.

Four varieties of embryos, taken from animals answering the description of *C. œstroides*, are described; but as it was found impossible to make out any differences in the adults, the question whether these varieties represent distinct species or polymorphic forms is left undecided.

II. "On the Determination of the Constants of the Cup Anemometer by Experiments with a Whirling Machine." By the Rev. T. R. Robinson, D.D., F.R.S., &c. Received March 14, 1878.

(Abstract.)

In his description of the cup anemometer (Transactions Royal Irish Academy, Vol. XXII), Dr. Robinson inferred from experiments on a very limited scale with Robins' whirling machine, that the ultimate ratio of the wind's velocity to that of the centre of the cups $=3$. Some recent experiments by M. Dohrandt show that this number is too great; but as some of the details appeared objectionable, and as they did not include all the necessary data for determining the constants, the author was desirous of repeating them. He was enabled to do this by a liberal grant from the Royal Society, and the results are given in this paper.

After describing the apparatus and the locality in which it was established, he proceeds to explain the conditions of an anemometer's action. Considering only two opposite cups, and supposing them in motion, the pressure on the concave surface is as that surface and the square of the resultant of the wind's velocity V and v, that of the anemometer, and as $a_{\prime}$, the pressure of an unit V on the cup normal to the arm.

This is opposed, 1. By the pressure of a similar resultant on the convex surfaces, and $a'_{\prime}$, another coefficient, also normal to the arm, but quite different from $a_{\prime}$; 2. By various resistances depending on v^2; and 3. By the friction of the machine estimated at the centres of the cups.

$a_{\prime}$ and $a'_{\prime}$ are functions of V, v, and θ, the angle which the wind makes with the arm, but it is impossible to determine them *à priori* in the present state of hydrodynamics. It is, however, obvious that if V be constant, the mean values of v, $a_{\prime}$, and $a'_{\prime}$ through one revolution will soon also become constant, and as the mean impelling and resisting forces balance each other, the condition of permanent motion is expressed by an equation of the form $a\text{V}^2-2\beta\text{V}v-\gamma v^2-\text{F}=0$; or $\text{V}^2-2x\text{V}v-yv^2-\frac{\text{F}}{a}=0$ (I), which, if the constants are known, gives